REMARKS/ARGUMENTS

Claims 1-6 are pending herein. Claims 3 and 4 have been amended hereby to correct matters of form and for clarification purposes only. Applicant respectfully submits that no new matter has been added, and that this Amendment is proper under Rule 116 because it does not raise any new issues by merely clarifying that the holder comprises the container. Thus, entry of this Amendment is respectfully requested.

1. Claim 5 was withdrawn by the PTO as being directed to a non-elected invention in view of the PTO's constructive election of claims 1-4 and 6.

Independent claim 1 recites that the semi-solid material includes, among other things, a semi-solidifying agent comprising one of agar and a whole egg. Claim 5, which depends from claim 1, narrows the scope to agar that is added in the amount of 1 gram to 200 ml of diluting liquid that is first added to the liquid nutrient solution. Claim 6, which was not withdrawn, similarly depends from claim 1 and similarly narrows the scope, but to a whole egg that is added in an amount of one whole raw egg per 250 ml of liquid nutrient solution.

Applicant respectfully submits that it is clear that independent claim 1 covers a semi-solidifying agent that is agar and also covers a semi-solidifying agent that is egg. Because independent claim 1 is generic to both claims 5 and 6, Applicant respectfully submits that claim 5 should be rejoined, reconsidered and allowed once generic independent claim 1 is deemed to be in condition for allowance. Further, Applicant respectfully submits that independent claim 1 is in condition for allowance for the reasons explained below, and respectfully requests that the PTO issue a Notice of Allowance for this application in due course.

2. The §112, second paragraph rejection of claims 3 and 4 is noted, but deemed moot in view of rewritten claims 3 and 4 submitted above. Accordingly, Applicant respectfully requests that the above rejection be reconsidered and withdrawn.

3. Claims 1 and 3 were rejected under §102(b) over Colarow. Applicant respectfully traverses this rejection.

Independent claim 1 recites a semi-solid enteral nutrition product for enteral administration directly to a stomach or intestines of a patient from an external container connected to an external portion of a feeding tube provided through a through-hole of a stoma formed through a portion of the abdominal and stomach walls of the patient upon the application of pressure to the external container. The semi-solid enteral nutrition product comprises a semi-solid material having a substantially self-supporting consistency that deforms to flow under an externally applied load without liquefying and that is capable of containing a higher concentration of a nutrient component than a liquid. The semi-solid material comprising a liquid nutrient solution and a semi-solidifying agent comprising one of agar and a whole egg that is added to the liquid nutrient solution, wherein the self-supporting consistency of the semi-solid enteral nutrition product remains substantially unchanged before, during, and after enteral administration of the semi-solid enteral nutrition product into the patient. The self-supporting consistency of the semi-solid enteral nutrition product is further maintained within the stomach or the intestines of the patient such that the semi-solid enteral nutrition product does not liquefy due to the body temperature of the patient.

Colarow discloses a food product which is a fluid material, such as sauce, dressing, mayonnaise, or cream, but does not disclose a semi-solid material having the characteristics defined in claim 1 that is directly administered to the stomach or intestines of a patient from an external container via a feeding tube upon the application of an external pressure to the container.

Applicant respectfully submits that the PTO has not properly considered the essential claim limitations defined in the preamble of claim 1. That is, the preamble of claim 1 includes claim limitations which deserve patentable consideration.

The United States Court of Appeals of the Federal Circuit stated that, "In general, a preamble limits the claimed invention if it recites essential structure or steps, or if it is necessary to give life, meaning, and vitality to the claim" *Eaton Corp.*

v. Rockwell Int'l Corp., 157 F.3d 1340, 1350 (Fed. Cir. 1998) (citing to *Catalina Mktg. Int'l, Inc. v. Coolsavings.com, Inc.*, 289 F.3d 801, 808 (Fed. Cir. 2002)).

In addition, the CAFC stated that "[a] claim preamble has the import that the claim as a whole suggests for it. In other words, when the claim drafter chooses to use both the preamble and the body to define the subject matter of the claimed invention, the invention so defined, and not some other, is the one the patent protects" *Bell Communications Research, Inc. v. Vitalink Communications Corp.*, 55 F.3d 615, 620 (Fed. Cir. 1995), and that "[w]hen limitations in the body of the claim rely upon and derive antecedent basis from the preamble, then the preamble may act as a necessary component of the claimed invention" *NTP, Inc. v. Research in Motion, Ltd.* (Fed. Cir. 2005).

In claim 1, the body of the claim recites "enteral administration of said semi-solid enteral nutrition product," "the patient," "the stomach or the intestines of the patient," and "the body temperature of the patient," which derive antecedent basis from and refer back to the particular administration, the particular nutrition product, the particular patient, the particular stomach or intestines, and the particular body temperature limitations first set forth in the preamble.

More specifically, enteral administration means administration directly to the stomach or intestines of a patient from an external container connected to an external portion of a feeding tube provided through a through-hole of a stoma formed through a portion of the abdominal and stomach walls of the patient, upon the application of pressure to the external container. The aforementioned particular patient refers to the patient recited in the preamble having the stoma previously-formed in their abdominal and stomach walls. The reference to the stomach or intestines means the stomach or intestines of the previously recited patient that are connected to the external container via the feeding tube disposed within the through-hole of the stoma of the patient. The particular body temperature means the temperature of the body of the previously mentioned patient having the stoma previously-formed in their abdominal and stomach walls.

In addition, Applicant respectfully submits that a close technical relationship

exists between the enteral administration of the enteral nutrition product via the feeding tube under pressure, as described in the preamble of claim 1, and the substantially self-supporting consistency of the enteral nutrition product that deforms to flow under an externally applied load as described in the body of the claim. That is, if an additional pressure or force is not externally applied to the semi-solid enteral nutrition product present within the container, then because the semi-solid enteral nutrition product is harder than a liquid, the semi-solid enteral nutrition product fails to deform and does not smoothly flow through the feeding tube, which typically has an even smaller diameter than the mouth or esophagus of the patient.

For the reasons explained above, Applicant respectfully submits that it is clear that the limitations recited in both the preamble and the body of claim 1 together define the subject matter of the claimed invention, and that the essential structures and features of claim 1 recited in the preamble are necessary to give life, meaning, and vitality to claim 1.

In order for an enteral nutrition product to be considered a "semi-solid material," in the context of claim 1, the enteral nutrition product is required to exhibit self-supporting consistency characteristics. That is, the enteral nutrition product is required to have a nature such that its physical form remains substantially unchanged unless and until a compulsory external force is loaded thereto. Applicant respectfully submits, however, that one of ordinary skill in the art would readily recognize that the sauces, creams and other foods of Colarow are simply not semi-solidified materials having a self-supporting consistency as claimed. Moreover, Applicant respectfully submits that there is no disclosure or even any suggestion in Colarow that any of the food disclosed therein would or even could exhibit such a self-supporting consistency that remains substantially unchanged unless a compulsory external force is loaded thereto.

Further, Applicant respectfully submits that there is no disclosure in Colarow that any of the composition components impart such semi-solid characteristics to provide the claimed substantially self-supporting consistency, much less that egg could in any way be considered to be the claimed semi-solidifying agent. That is, Colarow

teaches a heat-stabilizing composition suitably added to protein-containing emulsions (egg yolk, for example) in order to heat-stabilize the emulsions. Applicant respectfully submits that the composition in Colarow is a combination of a lysolecithin/polymer composition and a polymer selected from the group consisting of pectin, a food-quality gum and mixtures thereof. The composition does not contain egg yolk. Applicant respectfully submits that Colarow fails to teach that egg yolk functions as the heat-stabilizing composition.

With respect to a generally recognized meaning of the term "stabilizing" in the context of Colarow, Applicant respectfully submits the McGraw-Hill *Dictionary of Chemistry*, Second Edition defines the term "stability" as "the property of a chemical compound which is not readily decomposed and does not react with other compounds" (see McGraw-Hill *Dictionary of Chemistry*, Second Ed., page 355, a copy of which is attached hereto as Appendix A). Applicant respectfully submits that the term "stabilizing" does not in any way relate to providing an increase in the hardness of the consistency of a material.

Applicant respectfully submits that one of ordinary skill in the art would readily understand that the term "stabilizing" in Colarow and "semi-solidifying" recited in claim 1 are distinctly different in technical meaning from each other. That is, the term "stabilizing" used in Colarow refers to maintaining the emulsion such that it can function as an emulsifying agent and avoid an unintended coagulation (i.e., the stabilizing agent prevents a physical change from a liquid into a solid). In contrast, the term "semi-solidifying" in claim 1 specifically refers to an agent that specifically imparts a physical change from a liquid or fluid consistency to a semi-solid consistency. Indeed, Applicant respectfully submits that one of ordinary skill in the art would readily understand that these terms represent opposing concepts with respect to controlling the consistency of a material.

In view of the above, Applicant respectfully submits that Colarow simply does not disclose or even suggest an enteral nutritional composition comprising a nutritional liquid and a semi-solidifying agent, as defined by the limitations in claim 1.

Further, Applicant respectfully submits that Colarow fails to disclose or even

suggest that such an otherwise undisclosed semi-solid nutrition product could exhibit a characteristic wherein the shape or physical consistency is maintained during delivery from a container (under pressure) through a feeding tube into a patient, without liquefying due to the body temperature of the human body, as claimed.

That is, the enteral nutrition product according to the claimed invention is formulated to have pre-adjusted conditions including component organization and component ratio that allow the enteral nutrition product to exhibit the claimed self-supporting consistency before, during and after direct enteral administration of the product into the patient, and to continue to exhibit the self-supporting consistency, even after entry into the body of the patient, whereby the enteral nutrition product still does not liquefy due to the body temperature of the patient.

The above-described formulation of the claimed enteral nutrition product is provided to prevent the enteral nutrition product from refluxing toward the esophagus, even after the enteral nutrition product is administered to the stomach of a patient whose cardia has been deteriorated in function, such as an aged person. Gastro-esophageal reflux ("GER") of an enteral nutrition product is likely to cause diseases such as reflux esophagitis or aspiration pneumonitis. Thus, the enteral nutrition product according to the claimed invention effectively prevents such gastro-esophageal reflux, and eventually prevents reflux esophagitis and aspiration pneumonitis, meaning that the enteral nutrition product provides many health and medical benefits aside from its nutritional value.

In contrast, Applicant respectfully submits that Colarow fails to disclose or even suggest any food products suitable for direct enteral administration to patients suffering from swallowing difficulties via a feeding tube inserted in a stoma into the stomach or intestines, much less that such an otherwise undisclosed food product is or should be formulated so as to have such a component organization and component ratio to provide the characteristics described above.

For at least the foregoing reasons, Applicant respectfully submits that the essential claim limitations recited in the preamble must be given patentable consideration, and that Colarow does not disclose each and every limitation recited in

independent claim 1. Accordingly, Applicant respectfully submits that the §102(b) rejection of claims 1 and 3 over Colarow is improper, and respectfully requests that the above rejection be reconsidered and withdrawn.

4. Claims 1 and 3 were rejected under §102(b) over Ying's *Rice Pudding Recipe*. Applicant respectfully traverses this rejection.

Independent claim 1 is discussed in section 3 above.

Applicant respectfully submits that, like Colarow, Ying does not disclose each and every element recited in claim 1, including those essential elements recited in the preamble of claim 1. That is, Applicant respectfully submits that Ying's rice pudding is simply not, nor would one of ordinary skill in the art ever consider it to be, an enteral nutrition product as defined in claim 1 for direct administration to the stomach or intestines of a patient from an external container connected to a feeding tube provided through a stoma in the abdomen and stomach walls of the patient upon the application of pressure to the external container.

Applicant respectfully submits that there is no disclosure, or even any suggestion whatsoever, in Ying's recipe that Ying's common rice pudding, intended for ordinary oral consumption, could ever be used as an enteral nutrition product for direct administration in the claimed manner. Further, Applicant respectfully submits that there is simply no disclosure in Ying that the rice pudding would or even could have a substantially self-supporting consistency that deforms to flow under an externally applied load without liquefying; that the otherwise undisclosed self-supporting consistency of the pudding would or even could possibly remain remains substantially unchanged before, during, and after the otherwise undisclosed direct administration into the patient's stomach or intestines; or that the otherwise undisclosed self-supporting consistency is further maintained within the stomach or intestines of the patient such that the pudding, so administered, does not liquefy due to the body temperature of the patient, as recited in claim 1.

Moreover, while Ying teaches that egg is included in the recipe for cooking rice pudding, Applicant respectfully submits that the Ying recipe fails to disclose that egg

is specifically used to impart any particular consistency characteristics or performance behavior, much less that the egg is a semi-solidifying agent, as claimed. Indeed, Applicant respectfully submits that one of ordinary skill in the art would not have considered the egg used in Ying's rice pudding recipe to be a semi-solidifying agent without otherwise impermissibly relying on the disclosure of the present application, which teaches that the claimed semi-solidifying agent of the semi-solid enteral nutrition product is, in one instance, egg.

Some of the medical benefits provided to a patient who receives the claimed enteral nutrition product are described above. On the other hand, Applicants respectfully submit that the Ying recipe does not teach that ordinary rice pudding, intended for normal oral consumption, could ever possibly be directly administered via feeding tubes to the stomachs or intestines of patients having swallowing difficulties, much less that the resultant dessert could possibly have the claimed substantially self-supporting consistency to provide the characteristics recited in claim 1 in the first place, which without it would not be possible to be directly administered to the stomach or intestines of a patient via an external container upon the application of pressure to the external container in the claimed manner.

For at least the foregoing reasons, Applicant respectfully submits that Ying does not disclose each and every element recited in claim 1. Accordingly, Applicant respectfully submits that the §102(b) rejection of claims 1 and 3 is improper, and respectfully requests that the above rejection be reconsidered and withdrawn.

5. Claims 1-4 and 6 were rejected under §103(a) over Colarow, Ying's *Rice Pudding Recipe*, and the Kabushiki article. Applicant respectfully traverses this rejection.

Independent claim 1 is discussed above in sections 3 and 4.

Applicant respectfully submits that Colarow and Ying do not disclose each and every element recited in independent claim 1, as explained above in sections 3 and 4. In addition, Applicant also explained above that there is not even any suggestion in the applied references that Colarow's food product or Ying's dessert pudding would or

even could have the claimed substantially self-supporting consistency that deforms to flow under an externally applied load without liquefying and that exhibits the performance characteristics recited in claim 1.

Again, Applicant respectfully submits that there is not even any suggestion in Colarow or Ying that the food products disclosed therein could even possibly qualify as an enteral nutrition product for direct enteral administration through a stomach or intestines of a patient from an external container connected to an external portion of a feeding tube provided through a through-hole of a stoma formed through a portion of the abdominal or stomach walls of a patient upon the application of pressure to the external container, as required in independent claim 1.

In the Office Action, the PTO acknowledged that Colarow and Ying do not disclose a device containing the claimed enteral nutrition product, and applied Kabushiki and Kamarei in an attempt to overcome the admitted deficiencies of Colarow and Ying. The PTO asserted that one of ordinary skill in the art would have been motivated "to heat-treat the product shown in '339 and the pudding recipe in order to kill possible harmful pathogens in the eggs or milk. A skilled artisan would have been motivated to use the wider tubing of Kabushiki in order to ensure even flow of the thicker fluid diet. A skilled artisan would have been motivated to combine these teachings into the device of '339 in order to deliver the diet directly to the stomach of a person in need thereof" (Office Action, page 6, lines 7-12). Applicant respectfully submits, however, that the PTO is incorrect.

That is, Applicant respectfully submits that one of ordinary skill in art would not have been motivated to combine the applied references for any reason, much less in the manner suggested by the PTO, since there is no disclosure that Colarow's cream, for example, or Ying's rice pudding recipe would or could have any potential applicability as an enteral nutrition product for direct administration to the stomach or intestines of a patient who cannot swallow or otherwise orally receive nutrition. Applicant respectfully submits that the PTO has crafted the present rejection based entirely on hindsight, and that such hindsight-based analysis is simply impermissible.

In addition, Applicant, who is a Japanese gastroenterologist, respectfully

submits that he has provided medical treatments to patients at his own hospital using the products to which the claimed invention has been applied. Prior to filing the present U.S. patent application, Applicant filed a corresponding Japanese patent application that is substantially identical to the claimed invention pending herein, which has already been patented in Japan as Japanese Patent No. 3516673.

Moreover, Applicant has co-authored several medical reports relating to the claimed invention, which have been published in several well-known medical publications. Copies of two related articles, which are attached hereto as Appendices B and C, include: "Prevention of Late Complications by Half-Solid Enteral Nutrients in Percutaneous Endoscopic Gastrostomy Tube Feeding" *Gerontology International Journal of Experimental, Clinical and Behavioural Gerontology*, pp. 417-419, Vol. 50, No. 6, 2004; and "Prevention of gastro-esophageal reflux by an application of half-solid nutrients in patients with perculaneous endoscopic gastrostomy feeding" *Journal of the American Geriatrics Society*, pp. 466-467, Vol. 52, Issue 3, March 2004.

Applicant respectfully submits that the attached publications show that the present invention has been recognized by skilled artisans as being a substantial contribution in the field of gastroenterology, and further, that the present invention provides recognized medical benefits, beyond nutritional benefits, in real-life clinical applications. Applicant respectfully submits that the attached publications expressly show that skilled artisans recognize the importance and value of the heretofore unrealized achievements made by Applicant with respect to the present invention. Applicant respectfully submits that such peer recognition objectively demonstrates that the present invention is not merely an obvious combination of common pudding or cream or any other prior art.

For at least the foregoing reasons, Applicant respectfully submits that independent claim 1, and all claims depending therefrom, define patentable subject matter over the art of record, and respectfully requests that the above rejections be reconsidered and withdrawn.

If the Examiner believes that contact with Applicant's attorney would be advantageous toward the disposition of this case, the Examiner is herein requested to call Applicant's attorney at the phone number noted below.

The Commissioner is hereby authorized to charge any additional fees associated with this communication or credit any overpayment to Deposit Account No. 50-1446.

Respectfully submitted,

August 29, 2005
Date

Stephen P. Burr
Reg. No. 32,970

Nicole Buckner
Reg. No. 51,508

SPB/NB/gmh

Attachments: **Appendix A** - McGraw-Hill *Dictionary of Chemistry*, 2nd Ed., page 355.
Appendix B - *Journal of the American Geriatrics Society*, March 2004, pp. 466-467, Vol. 52, Issue 3, March 2004.
Appendix C - *Gerontology International Journal of Experimental, Clinical and Behavioural Gerontology*, 2004, pp. 417-419, Vol. 50, No. 6, 2004.

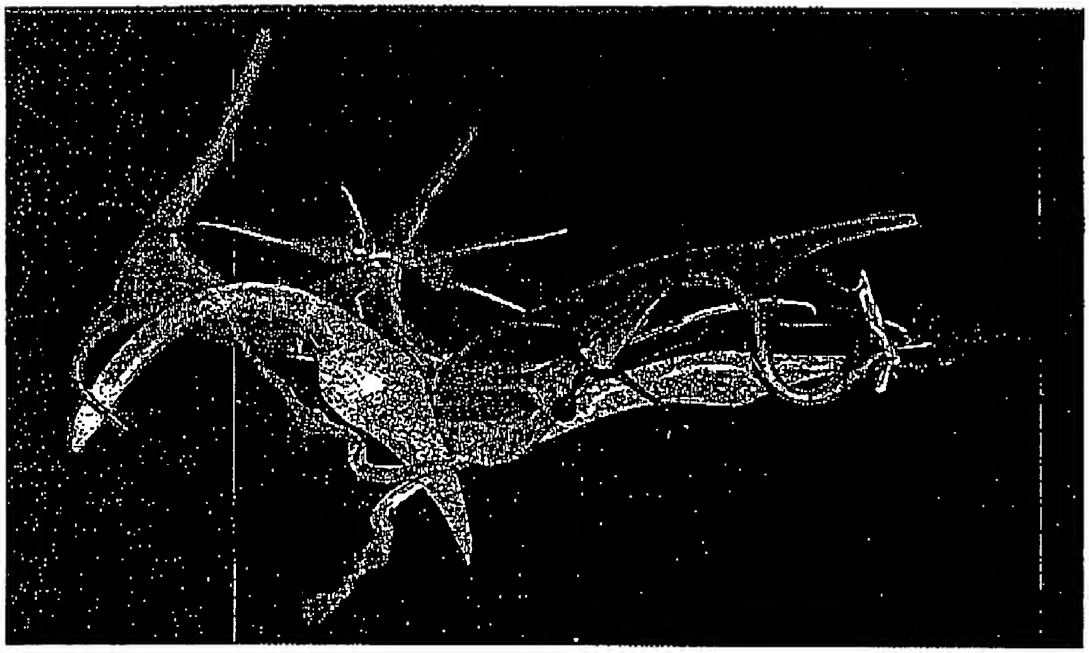
BURR & BROWN Customer No.: 025191
P.O. Box 7068
Syracuse, NY 13261-7068

Telephone: (315) 233-8300
Facsimile: (315) 233-8320

McGRAW-HILL

SECOND EDITION

DICTIONARY OF CHEMISTRY



MORE THAN 8,000 ESSENTIAL TERMS

COVERS EVERY DISCIPLINE OF CHEMISTRY

PROVIDES SYNONYMS, ACRONYMS, AND ABBREVIATIONS

The McGraw-Hill Companies

1 2 3 4 5 6 7 8 9 0 DOC/DOC 0 9 8 7 6 5 4 3

ISBN 0-07-141046-5

This book is printed on recycled, acid-free paper containing a minimum of 50% recycled, de-inked fiber.

This book was set in Helvetica Bold and Novarese Book by the Clarinda Company, Clarinda, Iowa. It was printed and bound by RR Donnelley, The Lakeside Press.

McGraw-Hill books are available at special quantity discounts to use as premiums and sales promotions, or for use in corporate training programs. For more information, please write to the Director of Special Sales, Professional Publishing, McGraw-Hill, Two Penn Plaza, New York, NY 10121-2298. Or contact your local bookstore.

Library of Congress Cataloging-in-Publication Data

McGraw-Hill dictionary of chemistry — 2nd. ed.
p. cm.
"All text in this dictionary was published previously in the McGraw-Hill dictionary of scientific and technical terms, sixth edition, c2003..."
— T.p. verso.
ISBN 0-07-141046-5 (alk. paper)
1. Chemistry—Dictionaries. I. Title: Dictionary of chemistry. II. Title: Chemisty. III. McGraw-Hill dictionary of scientific and technical terms. 6th ed.

QD5.M36 2003
540'.3—dc21 2002033183

On the cover: Blown-glass light sculpture filled with an inert gas mixture and lighted with high-frequency static electricity. (*Courtesy of Mundy Hepburn*)

APPENDIX A-2

from mutual attraction of two molecules is not negligible with respect to the molecules' average thermal energy at room temperature. { 'sfir əv ə'trak·shən }

spin label [PHYS CHEM] A molecule which contains an atom or group of atoms exhibiting an unpaired electron spin that can be detected by electron spin resonance (ESR) spectroscopy and can be bonded to another molecule. { 'spin ˌlā·bəl }

spinning-band column [ANALY CHEM] An analytical distillation column inside of which is a series of driven, spinning bands; centrifugal action of the bands throws a layer of liquid onto the inner surface of the column; used as an aid in liquid-vapor contact. { 'spin·iŋ ˌband ˌkäl·əm }

spin-polarized atomic hydrogen [PHYS CHEM] A system of hydrogen atoms cooled to a very low temperature in a very high magnetic field so that electron spins in almost all the atoms are antiparallel to the magnetic field, with the result that the atoms interact only through the weak triplet-state interaction so that no hydrogen molecules are formed. { 'spin ˌpō·lə,rīzd ə'täm·ik 'hī·drə·jən }

spiral wire column [ANALY CHEM] An analytical rectification (distillation) column with a wire spiral the length of the inside of the column to serve as a liquid-vapor contact surface. { 'spī·rəl ˌwīr 'käl·əm }

spiran [ORG CHEM] A polycyclic compound containing a carbon atom which is a member of two rings. { 'spīˌran }

spirit [ORG CHEM] A solution of alcohol and a volatile substance, such as an essential oil. { 'spir·ət }

spiro atom [ORG CHEM] A single atom that is the only common member of two ring structures. { 'spir·ō ˌad·əm }

spiro ring system [ORG CHEM] A molecular structure with two ring structures having one atom in common; for example, spiropentane. { 'spī·rō 'riŋ ˌsis·təm }

spontaneous combustion [CHEM] Ignition that can occur when certain materials such as tung oil are stored in bulk, resulting from the generation of heat, which cannot be readily dissipated; often heat is generated by microbial action. Also known as spontaneous ignition. { spän'tā·nē·əs kəm'bəs·chən }

spontaneous heating [CHEM] The slow reaction of material with atmospheric oxygen at ambient temperatures; liberated heat, if undissipated, accumulates so that in the presence of combustible substances a fire will result. { spän'tā·nē·əs 'hēd·iŋ }

spontaneous ignition *See* spontaneous combustion. { spän'tā·nē·əs ig'nish·ən }

spot test [ANALY CHEM] The addition of a drop of reagent to a drop or two of sample solution to obtain distinctive colors or precipitates; used in qualitative analysis. { 'spät ˌtest }

square planar molecule [CHEM] A molecule in which a central atom possesses four valence bonds directed to the corners of a square, with all atoms lying in the same plane. { 'skwer ˌplā·nər ˌmäl·əˌkyül }

Sr *See* strontium.

SRMS *See* structure resonance modulation spectroscopy.

SSD *See* steady-state distribution.

stability [CHEM] The property of a chemical compound which is not readily decomposed and does not react with other compounds. { stə'bil·əd·ē }

stability constant [CHEM] Refers to the equilibrium reaction of a metal cation and a ligand to form a chelating mononuclear complex; the absolute-stability constant is expressed by the product of the concentration of products divided by the product of the concentrations of the reactants; the apparent-stability constant (also known as the conditional- or effective-stability constant) allows for the nonideality of the system because of the combination of the ligand with other complexing agents present in the solution. { stə'bil·əd·ē ˌkän·stənt }

standard calomel electrode [PHYS CHEM] A mercury-mercurous chloride electrode used as a reference (standard) measurement in polarographic determinations. { 'stan·dərd 'kal·ə·məl i'lek,trōd }

standard electrode potential [PHYS CHEM] The reversible or equilibrium potential of an electrode in an environment where reactants and products are at unit activity. { 'stan·dərd i'lek,trōd pə,ten·chəl }

Prevention of gastro-esophageal reflux by an application of half-solid nutrients in patients with percutaneous endoscopic gastrostomy feeding

Jiro Kanie, MD, PhD*, Yusuke Suzuki*, MD, PhD, Hiroyasu Akatsu**, MD, PhD, Hiroshi Shimokata***, MD, PhD, Takayuki Yamamoto**, MD, PhD, Akihisa Iguchi* MD, PhD

* Department of Geriatrics, Medicine in Growth and Aging, Program in Health and Community Medicine, Nagoya University Graduate School of Medicine, 65 Tsurumai-cho, Showa-ku, 466-8550 Nagoya, Aichi, Japan (J Kanie, M.D., Y Suzuki, M.D., A Iguchi, M.D.)

** Department of Internal Medicine Fukushimura Hospital, 19-14, Yamanaka, Noyori-cho, Toyohashi, Aichi, 441-8124, Aichi, Japan (Hiroyasu Akatsu, M.D., Takayuki Yamamoto, M.D.)

*** Department of Epidemiology National Institute for Longevity Sciences, Morioka-cho Gengo 36-3, Obu-shi, 474-8522, Aichi, Japan (Hiroshi Shimokata, M.D.)

To the Editor: Although percutaneous endoscopic gastrostomy (PEG) feeding is widely used as a convenient method for long-term nutritional support[1], administration of liquid nutrients is often accompanied by complications such as vomiting or diarrhea. Vomiting, which may result in critical condition by aspiration, is presumably caused by gastro-esophageal reflux (GER). Therefore, we used half-solid nutrients for PEG feeding and examined whether this approach can reduce GER.

Seventeen patients (mean age ± SD; 79.9 ± 10.5), who were on PEG feeding participated in this study. Written informed consent was obtained from all patients. Either liquid or half-solid nutrients were administered via PEG tubing in a randomized order. Half-solid nutrients were prepared by mixing 5g of agarose with 500ml of liquid nutrients diluted with the same volume of water. Incidence of GER was assessed by computed tomography scan (CT) of the esophagus. Liquid nutrients were administered over 15 minutes in portions of 400ml containing 20ml of the water-soluble contrast material, Gastrografin (methylglucamine diatrizonate). The half-solid nutrients were administered by bolus injections of the same volume of nutrients, which were contained separately in 50ml syringes. Thirty minutes after the administration, CT scan was performed in 1cm thick slices of the esophageal portion. GER was confirmed if the Hounsfield number exceeded 100 in each slice examined. A Hounsfield number of 100 was employed because it can unequivocally distinguish the mixture of the nutrients containing contrast material from the esophageal and other surrounding tissues. The CT images were assessed by a radiologist, who was not informed of the type of nutrients used. Statistical comparison of the incidence of GER between the two types of nutrients was made using Mc Nemar's test.

GER was confirmed in 10 out of the 17 subjects (58.8%) when they received liquid nutrients. By contrast, when they received half-solid nutrients, only 4 of 17 subjects (23.5%) showed the evidence of GER from their CT findings. ($\chi^2 = 6.0$, df = 1, p = 0.014, by Mc Nemar's test) (Table 1).

The advantages of PEG feeding over nasogastric feeding has been discussed elsewhere albeit there have been some complications reported.[2] Among the complications, vomiting can be a cause of fatal aspiration due to a reflux of the administered nutrients.[3] The tubing used for PEG feeding has made it possible to apply half-solidified nutrients, which we hypothesized would cause less reflux from the stomach.[4] As expected, we observed less evidence of GER when using half-solid nutrients than when using liquid nutrients. We also confirmed that solidifying nutrients using agarose did not clog the tube as compared to liquid nutrients. Continuous infusion and careful observation of the patient's symptoms are considered necessary to reduce the risk of GER in PEG feeding. Also the patients are advised to remain in a sitting position during administration, which

may increase the risk of developing or exacerbating decubitus ulcers. Thus, this pilot study suggests that the use of rapid administration of half-solid nutrients in PEG feeding can reduce the risk of GER substantially, and may eventually contribute to a reduction of complications as well as to the improvement in the quality of life for patients and their cargivers.

REFERENCES

1. Gauderer MW, Stellato TA. Gastrostomie: Evolution, techniques, indications and complications, *Curr Prob Surg* 1986; 23: 657-719.
2. Dwolatzky T, Berezovski S, Friedmann R et al. A prospective comparison of the use of nasogastric and percutaneous endoscopic gastrostomy tubes for long-term enteral feeding in older people. *Clin Nutr* 2001; 20: 535-540.
3. Coben RM, Weintraub A, DiMarino AJ Jr et al. Gastroesophageal reflux during gastrostomy feeding. *Gastroenterology* 1994; 106: 13-18.
4. Kanie J, Kagami C, Yamamoto T et al. Case report: Half-solid enteral nutrient prevents chronic complications of precautious endoscopic gastrostomy tube feeding. Nippon Ronen Igakkai Zasshi. 2002; 39: 448-451.

Table 1. Occurrence of gastro-esophageal reflux by liquid and half-solid nutrients

Age	Sex	Clinical profile	gastro-esophageal reflux		Range of reflux		Distance from the EC junction	
			Liquid	Half-solid	Liquid	Half-solid	Liquid	Half-solid
82	F	Dementia	(-)	(-)				
81	F	Dementia	(-)	(-)				
90	F	Dementia	(+)	(+)	7	6	13	13
53	F	Cerebral infarction	(-)	(-)				
87	F	Dementia	(+)	(-)	4		13	
80	F	Dementia	(+)	(+)	9	4	9	10
82	M	Dementia	(+)	(+)	4	4	13	13
87	F	Cerebral infarction	(+)	(-)	1		4	
84	M	Cerebral infarction	(+)	(-)	12		15	
68	F	Cerebral infarction	(+)	(-)	13		13	
82	F	Dementia	(-)	(-)				
89	F	Cerebral infarction	(-)	(-)				
91	F	Cerebral infarction	(+)	(-)	1		2	
84	F	Cerebral infarction	(+)	(+)	15	10	15	10
87	F	Dementia	(-)	(-)				
68	M	Cerebral infarction	(-)	(-)				
64	M	Cerebral hemorrhage	(+)	(-)	5		8	
			10 (58.8%)	4 (23.5%)*				

Range of reflux: Number of slices where contrast materials were confirmed in the esophagus
Distance from the EC junction:
Distance from the esophageal-cardiac junction to the upper limit of the slices where contrast materials were confirmed (cm)
* Statistical significance by Mc Nemar's test ($\chi^2 = 6.0$, df = 1, $p = 0.014$)

Clinical Section

Gerontology

Gerontology 2004;50:417–419
DOI: 10.1159/000080181

Received: August 12, 2003
Accepted: February 16, 2004

Prevention of Late Complications by Half-Solid Enteral Nutrients in Percutaneous Endoscopic Gastrostomy Tube Feeding

Jiro Kanie[a] Yusuke Suzuki[a] Hiroyasu Akatsu[b] Masafumi Kuzuya[a] Akihisa Iguchi[a]

[a]Department of Geriatrics, Medicine in Growth and Aging, Program in Health and Community Medicine, Nagoya University Graduate School of Medicine, Nagoya, and [b]Department of Internal Medicine, Fukushimura Hospital, Toyohashi, Japan

Key Words
Percutaneous endoscopic gastrostomy · Enteral nutrients, half-solid · Gastroesophageal reflux

Abstract
Background: Percutaneous endoscopic gastrostomy feeding is accompanied by unique complications, which are not easily controlled. ***Objective:*** In an attempt to decrease complications, we used half-solid nutrients for percutaneous endoscopic gastrostomy feeding in an 85-year-old woman. The patient had been receiving enteral nutrients via percutaneous endoscopic gastrostomy, and we examined whether this approach can reduce complications. She presented with regurgitation of enteral nutrients and recurrent respiratory infections. ***Methods:*** Half-solid enteral nutrients, prepared by mixing liquid enteral nutrients with agar powder, were administered via percutaneous endoscopic gastrostomy. ***Results:*** Symptoms of gastroesophageal reflux disappeared immediately after the start of half-solid enteral nutrient feeding. ***Conclusion:*** Gastroesophageal reflux and leakage, two intractable late complications of percutaneous endoscopic gastrostomy tube feeding, can be alleviated by the solidification of enteral nutrients. Since this method allows quick administration of nutrients, it is also expected to help prevent the occurrence of decubitus ulcers and reduce the burden to the caregiver.

Introduction

Feeding via a percutaneous endoscopic gastrostomy (PEG) tube is a safe and efficient method for patients who cannot maintain adequate oral intake. PEG feeding is accompanied, however, by unique complications which are not easily controlled. The administration of liquid nutrients is often accompanied by complications such as vomiting and diarrhea, although these complications may be minimized if the patient is sitting up during the administration or if the nutrients are administered at a slower rate. Nevertheless, these methods do not completely succeed in eliminating these common complications, and may require the patients and their caregivers to have great patience. In addition, maintaining the same position for many hours may worsen the conditions of patients who have pressure ulcers. Here we report a case in which, by

KARGER
Fax + 41 61 306 12 34
E-Mail karger@karger.ch
www.karger.com

0304–324X/04/0505–0417$21.00/0

Accessible online at
www.karger.com/ger

Jiro Kanie
Department of Geriatrics, Medicine in Growth and Aging, Program in Health and Community Medicine, Nagoya University Graduate School of Medicine
65 Tsurumai-cho, Showa-ku, 466-8550 Nagoya, Aichi (Japan)
Tel. +81 52 744 2364, Fax +81 52 744 2371, E-Mail yus@med.nagoya-u.ac.jp

APPENDIX C-1

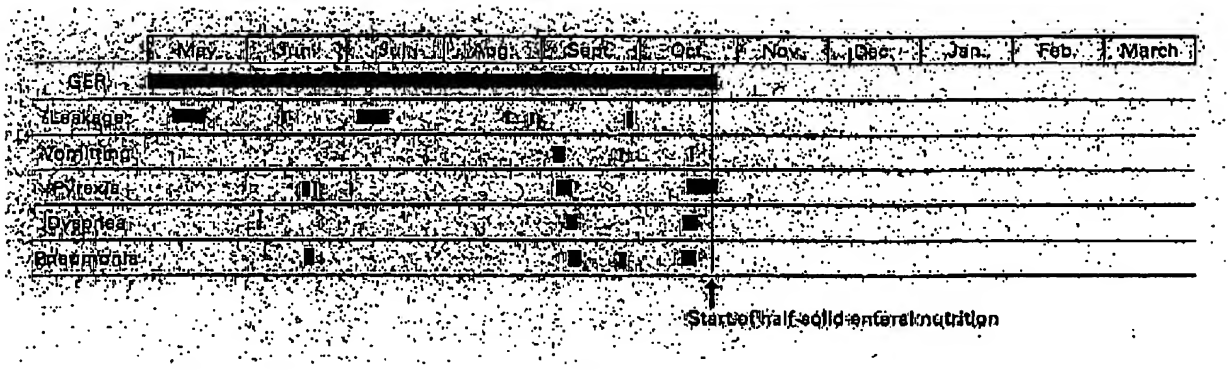


Fig. 1. Reduction of symptoms after half-solid enteral nutrition via PEG.

simply solidifying nutrients, the symptoms due to gastroesophageal reflux (GER) after PEG tube placement were relieved, and the leakage of nutrients from the PEG tube insertion site was alleviated.

Methods

An 85-year-old woman presented with regurgitation of enteral nutrients and recurrent respiratory infections after PEG placement. The patient suffered a cerebral infarction, and underwent PEG insertion on May 4, 2001, at a local hospital. After commencing PEG tube feeding, the following symptoms repeatedly occurred: regurgitation of the enteral feed; leakage of nutrients from the PEG tube insertion site; vomiting followed by pyrexia; dyspnea during the administration of nutrients, and pneumonia confirmed by chest X-ray. The patient often showed facial signs of discomfort during the feed administration. Liquid enteral nutrients were given in a sitting position at all times.

As the complications gradually became more frequent in occurrence, on October 21, 2001, we commenced giving her half-solid enteral nutrients which were prepared by mixing market-available enteral nutrients and agar powder. Half-solid nutrients were prepared by mixing 5 g agar powder with 500 ml liquid nutrients diluted with the same volume of water (1,000 ml total volume). The mixture was distributed into 50-ml syringes and kept in a refrigerator until it was administered via the PEG tubing. The mixture was not liquefied in the stomach due to body temperature. The administration of half-solid nutrients was made by injecting them into the stomach en bloc (injection time <5 min). The patient was not forced to remain in a sitting position during and after the administration.

Results

The symptoms, other than pyrexia, disappeared immediately after the administration of half-solid nutrients, and pyrexia vanished 2 weeks later. Also, the signs of discomfort during the feed administration were no longer noted. We followed the patient for up to 6 months after the start of the half-solid enteral nutrients, and observed no recurrence of the symptoms (fig. 1). At present (February 2004), the patient still remains in a stable condition and no longer suffers from the complications observed before the commencement of half-solid nutrients.

Discussion

PEG feeding is accompanied by unique complications, which occur over a long-term clinical course [1–3]. An increase in vomiting is one of the most common complications [4]. GER is clinically manifested by recurrent vomiting or aspiration. The mechanism by which GER increases in frequency has not yet been clarified.

Ogawa et al. [5, 6] suggested that since the stomach cannot move independent of the abdominal wall after the formation of a gastric fistula, enteral nutrients remain in the stomach longer, thereby increasing the chance of GER. Gastrin, a potent facilitator of peristaltic movement, may not be sufficiently induced by the distension of the stomach seen with slow infusion rates of liquid nutrients. Thus enhanced GER may eventually result. Since the nutrients can be administered in a short time by

APPENDIX C-2

our method (<5 min), the stomach wall is expected to be distended to a greater degree and thus stimulate peristaltic movement.

Another disadvantage of slow feed infusion is that patients are forced to remain in a sitting position for long periods while the nutrients are administered, which is unfavorable in terms of the prevention of decubitus ulcers, which are commonly found in patients with PEG feeding.

One of the late complications after PEG tube placement is leakage from the PEG tube insertion site. This is a difficult problem to cope with. There are two causes of leakage: inappropriate fixation of the bumper (including the so-called buried bumper syndrome [7]), and a decrease in the elasticity of the fistular opening, which develops over a long period after PEG placement [8]. The leakage resulting from a decrease in elasticity is intractable. Simply increasing the tube diameter cannot solve this problem [7, 9]. We found, however, that solidification of the enteral nutrients alleviated the leakage in the present case. This may simply be explained by the fact that the solidified nutrients could not be leaked out by the intragastric pressure through the narrow gap between the fistular pore and the tube.

So far, we have administered half-solid nutrients to 17 patients with PEG feeding and followed up the patients for 6 months. During the observation period, we confirmed significant reductions in the complications observed before the commencement of the half-solid nutrients (data not shown).

In conclusion, our experience indicates that the use of half-solid nutrients in PEG feeding and their rapid administration can substantially reduce the risk of GER and may eventually contribute to a reduction in complications as well as an improvement in the quality of life of the patients and their caregivers.

References

1 Dwolatzky T, Berezovski S, Friedmann R, et al: A prospective comparison of the use of nasogastric and percutaneous endoscopic gastrostomy tubes for long-term enteral feeding in older people. Clin Nutr 2001;20:535–540.

2 Kanie J, Shimokata H, Akatsu H, Yamamoto T, Iguchi A: Risk factors for complication following percutaneous endoscopic gastrostomy: Acute respiratory infection and local skin infection. Dig Endosc 1998;10:205–210.

3 Kanie J, Kono K, Yamamoto T, Akatsu H, Iguchi A: Gastro-esophageal reflux successfully treated with transgastrostomal jejunal tube feeding (in Japanese). Nippon Ronen Igakkai Zasshi 1997;34:60–64.

4 Kanie J, Kono K, Yamamoto T, et al: Usefulness and problems of percutaneous endoscopic gastrostomy in a geriatric hospital (in Japanese). Nippon Ronen Igakkai Zasshi 1998;35:543–547.

5 Ogawa S, Ikeda N, Koichi K, et al: Improvement of gastroesophageal reflux by percutaneous endoscopic gastrostomy with special reference to a comparison with nasogastric tubes. Gastroenterol Endosc 1995;37:727–732.

6 Ogawa S, Suzuki A, Morita T: Long-term followed up cases with percutaneous endoscopic gastrostomy with special reference to evaluation in infection of respiratory tract and gastric emptying. Gastroenterol Endosc 1992;34:2400–2408.

7 Klein S, Heare BR, Soloway RD: The 'buried bumper syndrome': A complication of percutaneous endoscopic gastrostomy. Am J Gastroenterol 1990;85:448–451.

8 Kanie J (ed): Percutaneous Endoscopic Gastrostomy (PEG) Hand Book, ed 1. Tokyo, Igaku-shoin, 2002, pp 57–58.

9 Gauderer MWL: Methods of gastrostomy tube replacement; in Ponsky JL (ed): Techniques of Percutaneous Endoscopic Gastrostomy. New York, Igaku-shoin, 1988, pp 79–90.

APPENDIX C-3